

U. S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
CALIFORNIA FOREST AND RANGE EXPERIMENT STATION
Division of Forest Insect Research

RELATION OF PINE ENGRAVER OUTBREAKS TO LOGGING
IN THE NORTH SIERRA PINE FOREST PRACTICE DISTRICT

Nature of the Problem

In the westside Sierra Subregion of northern California, outbreaks of pine bark beetles are frequently associated with logging operations in second-growth pine stands. In practically all cases these outbreaks are confined to the ponderosa pine type. They originate with a buildup of large populations of the California five-spined engraver, Ips confusus (Lec.), in the tops and large limbs of trees cut in the spring months. When no freshly cut material is available, this beetle will often infest living trees from mid-summer to fall, killing some trees outright and killing the tops of others. Trees topkilled by engravers frequently are attacked and killed completely by the western pine beetle, Dendroctonus brevicornis Lec., the principal insect enemy of ponderosa pine. It is this tendency of engraver outbreaks to pave the way for western pine beetle outbreaks that is the most serious aspect of the Ips problem.

Zone in Which Engraver Outbreaks Occur

Outbreaks of the California five-spined engraver ordinarily are restricted to the pure ponderosa pine type in areas under 4,500 feet in elevation. The location of the zone in which they generally occur is shown for the State as a whole by Struble and Hall.^{1/} The boundaries of this zone in the North Sierra Pine Forest Practice District are indicated on the attached map (fig. 1). In the portion of the zone lying within this Forest Practice District, tree species that the engraver breeds up in, other than ponderosa pine, are comparatively scarce. Consequently, they do not contribute to this problem.

Duration of Outbreaks

Populations of the California five-spined engraver fluctuate markedly and outbreaks usually do not persist for long periods. Struble and Hall state:

"As a general rule, outbreaks are sporadic and short-lived; they seldom persist in a given area much longer than a year. The beetles appear suddenly from mid-summer through fall and disappear almost as rapidly the next year, occasionally continuing into the second or even third year when associated with aggressive attacks of the western pine beetle." ^{2/}

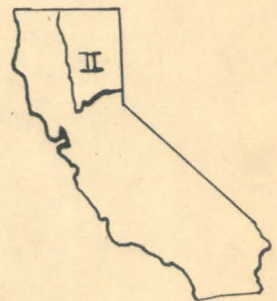
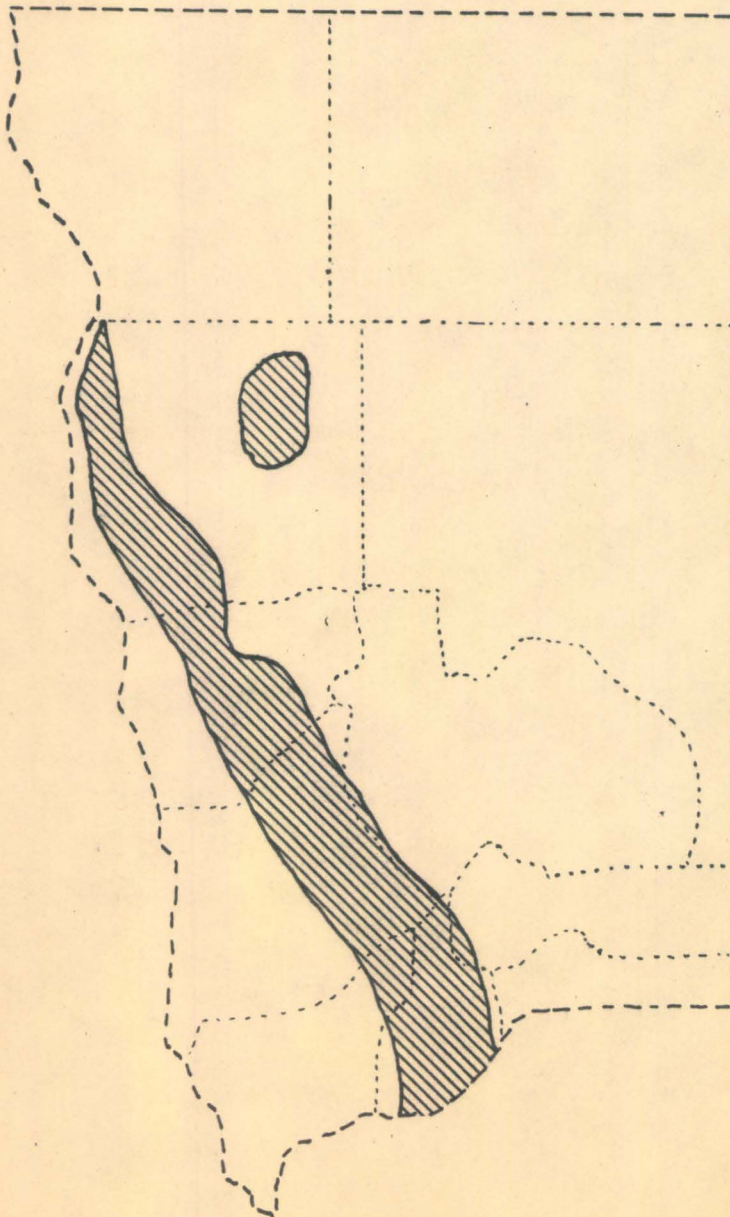
^{1/} Struble, G. R., and Hall, Ralph C. The California five-spined engraver - its biology and control. U. S. Dept. Agr. Cir. 964. 21 pp. Illus.

^{2/} Struble and Hall. *ibid.* pp. 3-4.

STATE OF CALIFORNIA
NORTH SIERRA PINE FOREST PRACTICE DISTRICTS



Critical Ips Damage Zone



II North Sierra Pine

There are many factors influencing fluctuations of five-spined engraver outbreaks. Studies made by the writer indicate that climatic factors are very important, particularly when climatic conditions favorable to the beetle coincide with the presence of large amounts of suitable breeding material. The most serious outbreaks during the past 15 years have occurred during years when seasonal precipitation has been well below normal. During these years of low precipitation, the intensity of local outbreaks has been closely associated with the amount of breeding material available in logging debris. The stem portions of unlopped tops of trees that the logger leaves in the woods are by far the most attractive and favorable breeding material. They contribute greatly to the problem.

Relation of Cutting Practices to Outbreaks

Time of cutting.--The season of the year in which a cutting is made is an important factor affecting engraver outbreaks. Generally speaking, logging debris created in cuttings made from February 1 to August 1 furnishes optimum breeding material for the five-spined engraver. Material from cuttings made between August 1 through January rarely results in outbreak populations.

Type of logging.--Sporadic cuttings create much more of a hazard than cuttings which continue throughout the season. Where the cutting operation is continuous, fresh material is continually being laid down which absorbs most of the beetles, and they are therefore less likely to attack the green stand.

Diameter of tree cut.--The diameter of the trees cut is an important factor affecting engraver outbreaks. More material suitable for breeding engraver beetle populations results from logging small trees than from large ones. The area of breeding material left in the tops following cutting of trees of different diameters is shown in Table 1. In cutting a single 18-inch tree, for example, more breeding material is left on the ground than is the case when a single 30-inch tree is cut. For each 1,000 board-feet of lumber taken out, 18-inch trees produce about 20 times more breeding material than do 36-inch trees. This is shown by the data in Table 2 and Figure 2, where the number of square feet of breeding surface left per 1,000 board-feet of timber cut out is given for trees of different diameters. Cutting operations within the zone in which five-spined engraver outbreaks usually occur commonly involve small diameter trees. Hence, the amount of suitable breeding material left in the woods is considerable, in comparison with operations in virgin stands.

Lopping.--Tops with limbs still attached produce about four times as many beetles as do tops that have been lopped. Lopping and scattering the limbs from the unused portion of the stem very effectively reduces the area suitable for breeding engraver beetles. Lopped limbs under 3 inches in diameter are no hazard unless they are piled. Lopping is in no sense a cure-all for the engraver problem, but it does reduce the population potential by about 75 percent.

Table 1.--Amount of Ips breeding area produced in logging slash,
by diameter classes and by different utilization standards

D.b.h.-inches	Square feet of breeding area	
	8"-top--d.i.b.	14"-top--d.i.b.
18	29	142
20	28	133
22	27	129
24	26	107
26	25	104
28	24	98
30	24	89
32	24	85
34	23	80
36	23	75

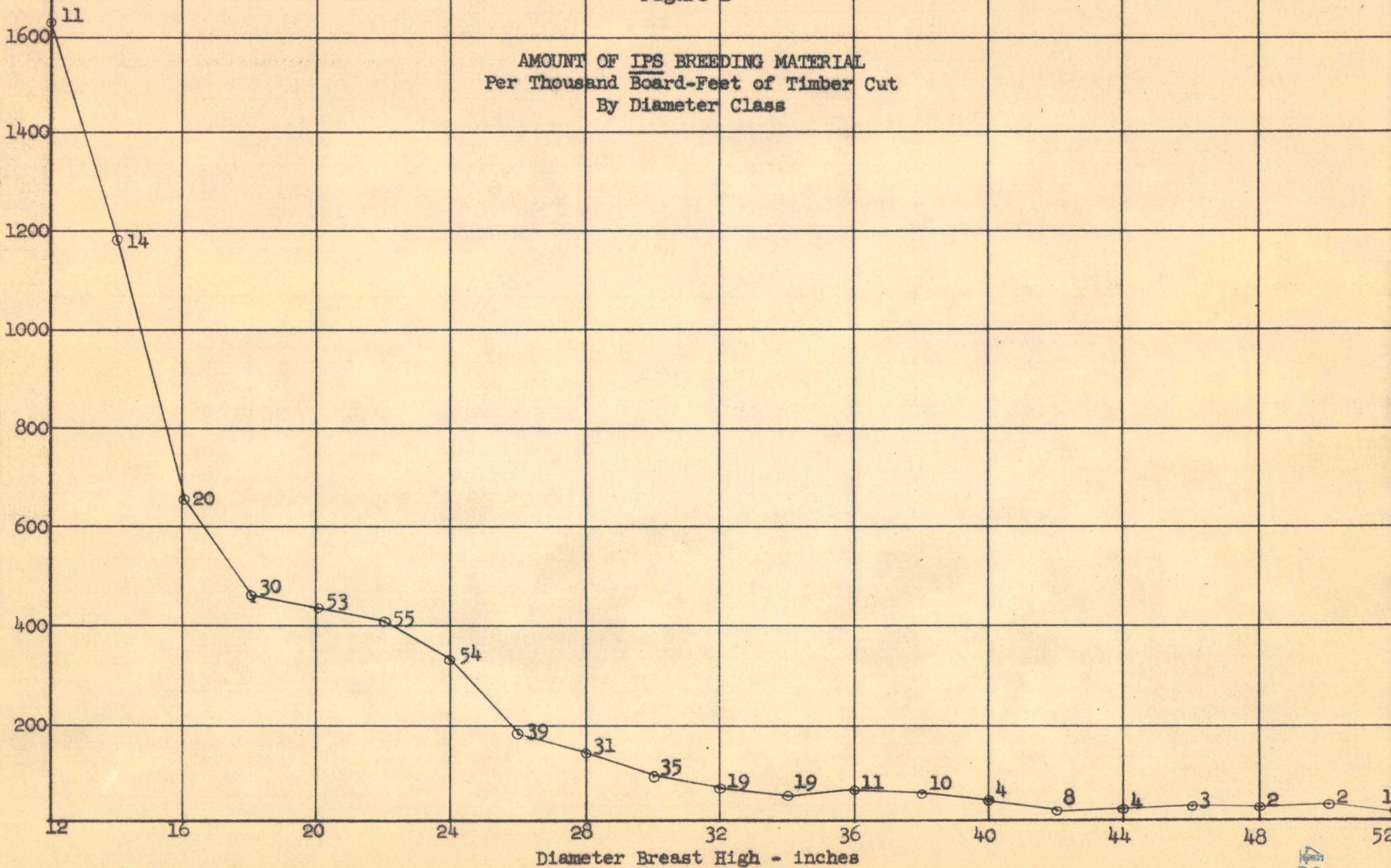
Table 2.--Amount of Ips breeding area produced per thousand board-feet
of lumber cut - by diameter and by different utilization standards

D.b.h.-inches	Square feet of breeding area	
	8"-top--d.i.b.	14"-top--d.i.b.
18	125	611
20	84	403
22	57	271
24	41	167
26	25	125
28	23	95
30	18	65
32	14	49
34	11	37
36	9	29

Area per thousand board-feet cut - square feet

Figure 2

AMOUNT OF IPS BREEDING MATERIAL
Per Thousand Board-Feet of Timber Cut
By Diameter Class



Relation of Utilization Standards to Outbreaks

The degree to which felled trees are utilized is one of the most important factors affecting the amount of breeding material available for the beetles. For example, if a 22-inch tree is cut and utilized to an 8-inch top, the area of breeding material remaining is only 27 square feet. However, if utilization is to a 14-inch top, there remains 129 square feet of breeding area, or almost five times as much (Table 1). In some cuttings observed, only the first log of 30-inch trees was removed from the woods. In these cases, there remained 240 square feet of breeding area per tree, or nine times the amount that would have been cut if utilization had been to an 8-inch top. Closer utilization is one means by which the hazard of engraver outbreaks following cutting in second-growth ponderosa pine stands can be greatly reduced.

Direct Control

Direct control methods for the five-spined engraver are laborious and costly. The need for them can be avoided by adherence to practices aimed at reducing the amount of breeding material in accordance with the principles already discussed. Where, for economic or other reasons, it is not feasible to avoid leaving quantities of breeding material in logging operations, such material should be kept under surveillance. If indications are found that large populations of engravers are breeding in it, steps can be taken to treat the material before the broods mature and the beetles emerge to attack the green stand. Direct control methods described by Struble and Hall ^{3/} are effective.

Summary

Outbreaks of the California five-spined engraver, originating from the residue of cutting operations, are an important factor contributing to the development of western pine beetle infestations in second-growth ponderosa pine in the westside Sierra Subregion. These outbreaks can be materially reduced by reducing the amount of favored breeding material. This can be accomplished by utilizing trees to an 8-inch top diameter, by avoiding the cutting of small-diameter trees, and by lopping and scattering the limbs from unused portions of tops. Outbreaks can also be minimized by confining logging operations within the second-growth ponderosa pine belt to late summer, fall, and early winter. Where it is not practicable to adjust cutting practices so as to minimize the amount of breeding material, the residue of logging operations can be kept under surveillance and direct control methods applied to destroy the beetles before they emerge and attack the green stand.

^{3/} Struble and Hall. *ibid.* pp. 18-19.
